A Review of the Eratoidae

(Mollusca : Gastropoda)

BY

CRAWFORD N. CATE

Museum Associate, Invertebrate Zoology, Los Angeles County Museum of Natural History, Los Angeles California 90007

(15 Plates; 13 Text figures)

FOREWORD

According to Schilder (1971), there are 148 specific and subspecific names given to the fossil and Recent species of the Eratoidae. These are divided into 4 categories: **1:** 93 names for fossil species, 75 of which appear to be valid; **2:** 18 are synonyms, or invalid for other reasons. The Recent taxa total 55 names: **3:** 29 are conceded to be valid; **4:** and 26 seem to be synonyms, or otherwise invalid.

Schilder (1971) systematics for the higher taxa, as well as his generic arrangement, have been adopted for this study. In the superfamily Triviacea Troschel, 1863, there are two divisions, the families Triviidae Troschel, 1863, and Eratoidae Schilder, 1927. It is the latter group with which this report is concerned. Thus, the subfamily Eratoinae Schilder, 1927, establishes the basis for the tribe Eratoini of Schilder, 1927, which is made up of 8 genera. Two of the genera, *Proterato* Schilder, 1927 and *Archierato* Schilder, 1932, are devoted entirely to groups of fossil species; a third genus, *Eratopsis* Hoernes & Auinger, 1880, represents a group of 17 species, all of which are fossil, except one. However, as does the genus *Eratopsis*, the remaining genera contain both fossil and Recent species.

Schilder (personal communication) said his generic and specific systematic arrangement of these animals more or less represents their ascendancy from ancient times up to the most recently evolved representatives.

INTRODUCTION

It is said the species of the Eratoinae constitute the most ancient branch of the Eratoidae, with the latter family group representing the most primitive section of the superfamily Triviacea (Schilder, personal communication); they appear to have emerged sometime during the Oligocene. The distribution of the members of this family seems to be widely diversified throughout the world's seas; as fossils they appear in significant numbers in the land masses of eastern and southern Europe.

Schilder's (1933) in-depth studies of these shells have shown the Eratoidae to be different from other family groups of the Triviacea in practically all of their characters, including the more obvious anatomical and morphological ones. It is true that the shape of the eratoid shells may on occasion resemble some shell forms in the Marginellidae (cf. *Marginella granum* Philippi, 1850) (Figure *53*). However, according to Schilder (*op. cit.*), the anatomy of these animals differs to the extent that they more closely approach that of the Triviacea.

These molluscan species, most of which are quite small, have been variously referred by early authors to *Marginella*, *Voluta*, *Columbella*, *Bulla*, *Volvaria,* and *Acteon*. The taxonomic position was clarified when Risso, in 1826 (4: 240), proposed the name *Erato*. Gray (1832) and Sowerby 2nd (1859) both accepted the name, even though some other authors, notably Kiener (1834), continued to associate these animals with the Marginellidae.

Troschel (1863) showed that the radulae of both the Eratoidae and Triviidae are very similar, nearly identical at times.

Except for Schilder (1933), little in-depth work has been undertaken with these shells. His work was significant in that it brought into focus the many obscure species of the Eratoidae. He illustrated many of the species with line drawings (some of which are used, with the kind permission of the late Dr. Maria Schilder, in this report for purposes of identification). However, it has been found that where species have similar shell morphology, draw-

ings seem to lose that variable, minute detail so important to correct identification.

It is the primary purpose of this work to bring together all of the currently known Recent species of the Eratoidae, listing the apparently valid forms, with their synonymy, and illustrating the species with photographs of their type specimens. In some instances, species will be redescribed because of inadequate original descriptions but using fresh specimens at hand. Attention is given to modern, more precise localities, when available; new distributional ranges are given, where known; and type localities are designated when necessary.

The morphological differences between eratoid species are often quite marginal, and most species are so small that it is not surprising that the valid species and their synonymy are often not clearly understood.

Smith (1910: 13) listed all *Erato* species known to him, adding his comments and recording the synonymy as he then perceived it. Also listed were the monographs and catalogues available at that time. Smith based much of his criticism of earlier authors on misinformation they had copied from the labels in the Cuming collection, which were often incorrect as to identification and locality.

As with the Ovulidae (Cate, 1973), it was found that the only definitive determination of a species, especially where shell forms are similar, would be possible from access to either the holotype itself or good photographs of it. Therefore, an attempt has been made herein to provide photographs of the types of all species bearing valid names, and of the types of as many synonymous species as possible so that all doubt may be reduced as to correct species identification.

Since several of the holotypes had not been specifically designated, the author has selected lectotypes from the original type lots to represent those species.

Shell Characters Common to Most Eratoidae

Several minor morphological details will be noticed in the study of these shells; however, the following is a general outline of their outstanding characters: the shell is almost always quite small, the largest species known at present being *Hespererato vitellina* (Hinds, 1844) (length 16.0 mm).

The shells are mostly conical in outline, with the front terminal collar attenuated to a blunt end; adapically, the spire is almost always prominent rather than flattened; the outer lip angles away from the shell axis, whereas posteriorly it right-angles acutely back to the columella; outer lip is thickened, barely shouldered above; outer lip is denticulate, somewhat declivous toward the front; body whorl side margin is rounded, convex; the aperture, angling off to the rear, is broad and straight; the front terminal beak is broad and well defined; the posterior outlet is usually shallow or closed, although in a few species it may be clearly open.

The columellar teeth may differ in width of interstices, size and shape tend to become less distinct, even obsolete adapically; always lacking are the bold, long, heavily formed plicae characteristic of the Marginellidae; there may be a weak, oblique ridge at the rear apertural canal; the fossular depression is very shallow or flattened, but narrow and distinct; the columellar base is rounded, convex, smooth; the outer shell surface is smooth, may be faintly glossy except for a few species that have granulations, wholly or in part, dorsally.

Most species are of some shade of white or grey; some are solid in color, others three-banded in olive or flesh pink; none of the species are dorsally spotted; the terminals or spire may be colored pale pink to brown.

Due to the overall similarity in dorsal shell form and shell outline among the species, particular attention

Explanation of Figures *1* to *4a*

Figure *1*: *Proterato (Sulcerato) lachryma*, BMNH photo; [1][1], lectotype × 13

Figure *1a*: *Proterato (Sulcerato) lachryma*, Draper photo. [1] × 11

Figure *2*: *Erato denticulata*, Draper photo, [1], lectotype × 10

Figure *3*: *Proterato (Sulcerato) angistoma angistoma*, BMNH photo; [2], lectotype × 20

Figure *4*: *Erato pellucida*, BMNH photo [2]; lectotype × 18

Figure *4a*: *Erato pellucida* var., BMNH photo; [2] × 19

[1] Numbers in square brackets refer to species numbers in the text

Figure 1

Figure 1a

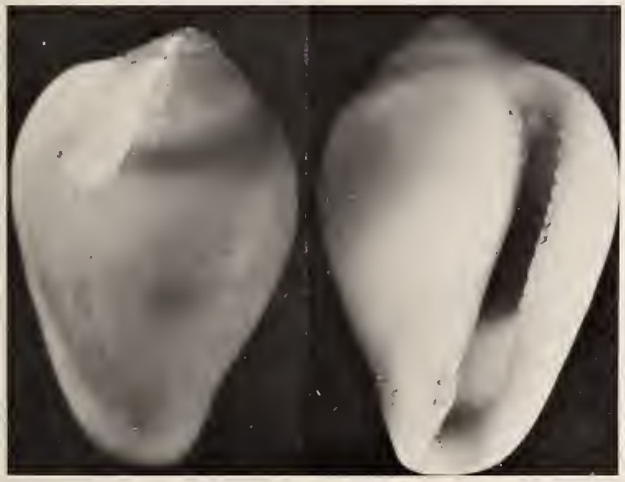

Figure 2

Figure 3

Figure 4

Figure 4a

should be given to the details of the aperture, outer lip, columellar lip, and dentition present, for identifying the various species.

ACKNOWLEDGMENTS

A paper of this scope, whose elements extend to many far-off centers of learning, required the help of many generous workers. Without their unselfish contribution, this work would have been impossible to complete.

I wish therefore especially to thank Kathie Way, British Museum (Natural History) for her help in assembling much of the type material and photographs, which, in essence, are the very backbone of this study. There are many others whose efforts contributed a great deal also, and to all of them, some of whom may have been left unmentioned, I wish to extend my appreciation.

To the following persons I wish to extend a special thanks: Hans Bertsch, Berkeley; K. Boot, Exeter; Dr. Kenneth J. Boss, Harvard University; S. Peter Dance, Cardiff; B. Draper, Los Angeles; Jean M. Cate, Rancho Santa Fe; Dr. June Chatfield, Cardiff; Dr. Tadashige Habe, Tokyo; Dr. A. Myra Keen, Palo Alto; Dr. R. Kilias, Berlin; Dr. James McLean, Los Angeles; Dr. Barbara J. Nielsen, Melbourne; Dr. Winston F. Ponder, Sydney; Dr. Joseph Rosewater, Washington; Nancy Rulon, Philadelphia; Gale G. Sphon, Los Angeles; A. M. Testud, Paris; C. S. Weaver, Lanikai; Dr. Wolfgang Zeidler, Adelaide; and Dr. A. Zilch, Frankfurt a. M.

SYSTEMATIC ACCOUNT

TRIVIACEA Troschel, 1863

ERATOIDAE Schilder, 1927

Eratoinae Schilder, 1927

Eratoini Schilder, 1927

Proterato Schilder, 1927

Type species: *Erato neozelanica* Suter, 1917 [OD]

SCHILDER (1971: 12) restricted this genus group to 11 fossil species. The shells of *Proterato* have the terminal ridge and abapical columellar teeth somewhat parallel, with a tendency to become transverse on some shells; and, for the most part, the shells are color-banded.

(Sulcerato) Finlay, 1930

Type species: *Erato illota* Tate, 1890 (fossil) [OD]
Trans. Roy. Soc. Austral., 1890, 13: 216
ibid. (see Vol. 13 in Vol. 15, 1892, plt. 13, fig. 11 for illustration)

There are about 20 species in this subgenus, only 5 of which are fossil. Schilder separates this group from *Proterato* because the shells are more conical in outline, with less constriction of the shell abapically. The fossula is comparatively deeper, almost straight.

1. *Proterato (Sulcerato) lachryma* (Sowerby 2nd, 1832)

(Figures *1*, *1*a, *2*)

1832 *Erato lachryma* Sowerby 2nd, Conch. Illustr., *Erato* (in Cypraeidae): 15; fig. 48
1832 *Erato fascia* [err.] Gray, Descr. Cat. Shells (proofs only, not published)
1837 *Erato lachryma* syn. *Lachryma trifasciata* (Humphrey Ms) Sowerby 2nd, Cat. Res. Cypraeadae [sic] :15.
1870 *Erato guttata* Sowerby 2nd, Thesaur. Conchyl., *Erato* 82 (6); figs. 29-30 (non *E. guttula* Sowerby 2nd, 1832, Conch. Illustr., *Erato*: 16; fig. 50 = *Marginella*)
1877 *Erato angiostoma* [err.] Angas, Proc. Zool. Soc. London 1877: 182
1882 *Erato lacrima* [err.] Dunker, Index Moll. Maris Japonici: 257
1901 *Erato denticulata* Pritchard & Gatliff, Proc. Roy. Soc. Victoria, 13: 133 [Figure 2 herein]
1932 *Lachryma trifasciata* Cotton & Godfrey, So. Austral. Naturalist 13: 45

Original Description: "*Erato lachryma* – – Shell oval, turbinate, whitish, with three transverse bands [reddish-brown to brownish-purple], smooth; aperture narrow; outer lip somewhat thickened, minutely toothed on its inner edge; columellar lip slightly concave, toothed anteriorly." (SOWERBY 2nd, 1832 (5): 15).
(Sowerby appears not to have designated holotype specimens for his eratoid species – Way, *in litt.*)

Measurements: "Length 0.2, breadth 0.13" [inches] [= approximately L – 5.0; W – 2.5 mm] (Sowerby, *ibid.*).

Measurements, Reeve figured specimen: L – 5.5 mm (Way, *in litt.*)

Measurements, hypotype (Figure *1*a): L – 5.6; W – 3.6; H – 2.7 mm (C 4022)

Type Locality: "New South Wales."

Distribution: St. Vincents Gulf, South Australia, to approximately Moreton Bay, Queensland, East Australia.

Reeve's Figured Specimen: BM(NH), **lectotype** designated herein (Way, *in litt.*)

Discussion: Sowerby 2nd made the following comment: "... several specimens were in the cabinet of the late G. Humphrey." There are 4 syntypes in the type lot (Way, *in litt.*). The specimen illustrated in Figure *1* was interpreted by Smith (1910: 17) to be *Erato callosa* A. Adams & Reeve, 1850; however, it appears to have been correctly identified as "*Erato*" *lachryma* Sowerby 2nd, 1832.

The dorsal bands of color do not extend onto either the columella or the outer lip. Both apertural margins are denticulate: usually restricted to about 10 weak teeth on the front columella, more numerous with about 22 on the axial edge of the outer lip.

2. *Proterato (Sulcerato) angistoma angistoma* (Sowerby 2nd, 1832)

(Figure *3*: **lectotype**; Figures *4*, *4*a)

1832 *Erato angiostoma* Sowerby 2nd, Conch. Illustr., *Erato* 16: fig. 51
1859 *Erato angyostoma* [err.] Sowerby 2nd, Thesaur. Conchyl., *Erato* (13): 83;figs. 19-20, 23-24
1865 *Erato pellucida* Reeve, Conch. Icon., *Erato* 15: fig. 16. **Lectotype:** BM(NH), Reg. No. 197414/1 (Way, *in litt.*) Figure *4* herein

Original Description: "*Erato angistoma* – – Shell ovate, gibbose, pallid; spire short; aperture as long as the whole shell, very narrow; outer lip rather thickened, wide, very minutely toothed along its inner margin; columella with six or seven anterior folds and internal cavity [fossula]." (Sowerby 2nd, 1832 (7): 16)

Measurements: "Length 0.2, breadth 0.15 [inch]" [= approximately L – 5.0; W – 3.5 mm] (Sowerby, *ibid.*).

Measurements, lectotype: "L – 3.4 mm" (Way, *in litt.*)

Type Locality: "From the East Indies."

Distribution: East Australia, western East Indies; Oman, Erythraean coast; Arabian Sea; Persian Gulf; Red Sea

Lectotype (designated herein): BM(NH), Register No. 197415/1. Type lot consists of 3 syntypes.

Discussion: Sowerby appears not to have singled out a holotype. The lectotype illustrated herein (Figure *3*) is probably the best specimen of the lot. Sowerby 2nd (1859: 83) made the following comment: " A rather globose, pyriform, small, white, smooth species, with the outer lip thick in the middle, and elevated into an angle above even the spire." He added Sorsogon, Luzon Island, Philippines, apparently having used a Cuming label locality.

Schilder (1933: 260) seems to have thought this species rather closely related to *Proterato (Cypraeerato) angulifera* (Sowerby 2nd, 1859), listing their differences thus: less numerous denticulation on the outer lip; the posterior outer lip angle less acute, and with granulations around the apex. Subsequently, after having examined additional specimens, Schilder (1941: 69) appears to have come to the conclusion that they were actually very different from one another, even to the extent of placing them into different subgenera.

3. *Proterato (Sulcerato) angistoma schneideri* (Schilder, 1933)

(Figure *5*, holotype)

1933 *Erato (Cypraeerato) schneideri* Schilder, Zool. Anz. 102 (11/12): 294, 296; fig 7

Original Description: "*Erato (Cypraeerato) schneideri* – – *Schneideri* differs from *sulcifera* [Sowerby 2nd, 1832] mainly through complete lack of the dorsal furrow and the [anterior end] spots, the granules are obsolete and mostly only recognizable posteriorly; further, *schneideri* is somewhat larger, slenderer, the [anterior] end is nar-

Explanation of Figures 5 to 7b

Figure *5*: *Proterato (Sulcerato) angistoma schneideri*, ZM photo holotype [3] × 12
Figure *5*a: *Proterato (Sulcerato) angistoma schneideri*, Draper photo, [3] × 11
Figure *6*: *Proterato (Sulcerato) olivaria*, BMNH photo, holotype [4] × 12
Figure *7*; *Proterato (Sulcerato) tomlini*, ZM photo, holotype [5] × 12
Figure *7*a: *Proterato (Sulcerato) tomlini*, Draper photo, hypotype 1 [5] × 12
Figure *7*b: *Proterato (Sulcerato) tomlini*, Draper photo, hypotype 2 [5] × 13

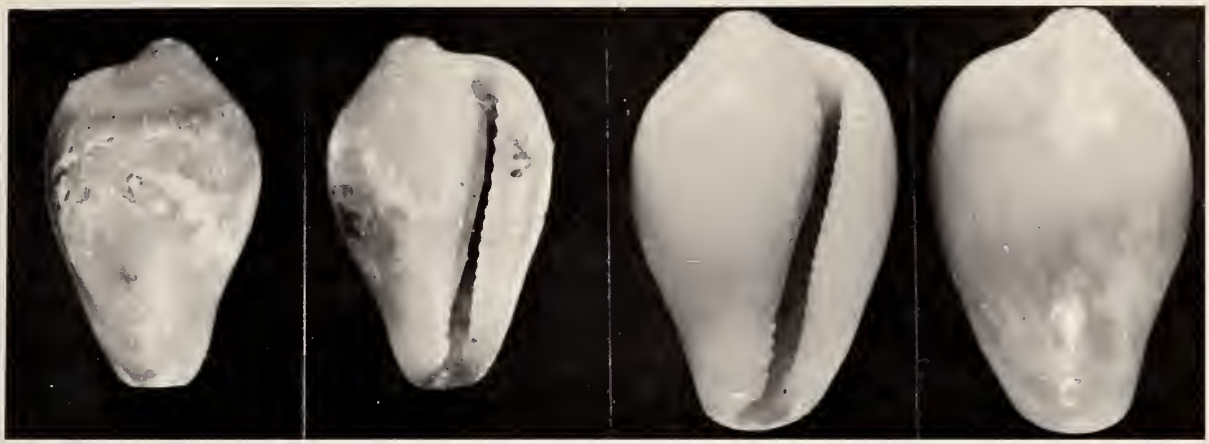

Figure 5 Figure 5a

Figure 6 Figure 7

Figure 7a Figure 7b

rowed, drawn out. Teeth often shorter, fossula perhaps somewhat narrower, shell pale green ([side] frequently covered with white) to almost pure white." (SCHILDER, 1933: 296)

Measurements, holotype: Figure 5. "Vergr. 12 (Kilias, *in litt.*) -- L - 3.9; W - 2.4 mm

Measurements, hypotype: (Figure 5a herein): L - 5.1; W - 3.0; H - 2.7 mm (C3631)

Type Locality: New Britain, Bismarck Archipelago (between 1° and 6°20′ S and 145° and 154° E).

Distribution: Purdy Island, Admiralty Islands; beach, NW Cape, NW Australia (C3631).

Holotype: M Z, No. 78598 (Kilias, *in litt.*)

Discussion: The hypotype, from the beach drift at NW Cape, Vlaming Head, Light house, was collected by Molly Gedling (now of Rottnest Island Light, SW Australia) 24 June 1969. Thus the species' range is extended westward by the width of N Australia.

4. *Proterato (Sulcerato) olivaria* (Melvill, 1899)

(Figure 6: holotype)

1899 *Erato olivaria* Melvill, Ann. Mag. Nat. Hist. (7) 4: 91; plt. 1, fig. 9

Original Description: "*Erato olivaria -- E. testa arcuato-pyramidata, solida, laete olivacea, apice subconico; anfractibus quatuor, supernis interdum rugosulis, interdum laevibus, ultimo anfractu laevi, rapide accrescente, tumidulo, pyriformi, apud basim paullum attenuato; apertura angusta, oblonga; labro exteriore crassiusculo, denticulis quindecim intus praedito, margine columellari, et praecipus versus basim, incrassato, denticulato.*" (MELVILL, 1899: 91)

Measurements, holotype: "Long. 6, lat. 3.25 mm." [L - 5.5 mm, Way, *in litt.*]

Type Locality: "Hab. Karachi" [Pakistan].

Distribution: South East Asia, west, NW coast of India

Holotype: BM(NH), Register No. 1899.12.18.39 (Way, *in litt.*)

Discussion: Melvill had a few solid, smoothish specimens about which he commented: "... conspicuous for its bright olive hue; the apex is subconical; whorls four, the last being large, pyriform, somewhat attenuate at the base, the mouth narrowly oblong; outer lip thickened, denticulate within, with fifteen little teeth; columellar margin thickened, especially towards the base, and then also denticulated. The species slightly resembles the European *E. laevis*, Donovan. The only other known species of uniform green or olive hue is *E. prayensis* Rochebrune [1881], from Cape Verde Islands, but, from description, would seem to differ both in form and lip-characters."

5. *Proterato (Sulcerato) tomlini* Schilder, 1933

(Figure 7: holotype)

1933 *Proterato tomlini* Schilder, Proc. Malacol. Soc. London 20 (5): 273; fig. 14

1971 *Proterato (Sulcerato) lepida* (Gould, 1861) [= *Marginella*] SCHILDER, Cat. Liv. Foss. Cowries. Inst. Roy. Sci. Nat. Belg.: 12 [Figure 9 herein: holotype]

Original Description: "*Proterato tomlini* -- Allied to *callosa*, but smaller, aperture narrow, fossula broader, and more concave; sub-pellucid, with two or three pale olivaceous bands which are narrow, distinct, and become often obsolete." (SCHILDER, 1933: 273)

Description, hypotype: Shell solid, often broad subcentrally; aperture at an angle to the axis, straight (perhaps a gentle curve may be present); outer lip numerously, very finely denticulate, with restricted dentition on front columella-fossula margin, with 3 heavy denticular ridges obliquely traversing the abapical base; shell glossy, off-white, with mostly indistinct clouding, banding of pale green (C4068A)

Measurements, holotype: approximately 3.1 mm, without spire

Measurements:
hypotype 1 (C4073) (Figure 7a): L - 5.7; W - 3.8; H - 3.0 mm
hypotype 2 (C4068) (Figure 7b): L - 5.2; W - 3.5; H - 2.8 mm

Type Locality: "Japan" [collected by A. Adams, 1862]

Distribution: C4073 - Genkai Nada, in 39 m of water, off Fukuoka, Kyushu; C4068A from same locality; C 4097 - Moeshima, Kagoshima Bay, Kyushu, Japan [*ex* Hirohito coll., Habe, *in litt.*].

Holotype: *ex* Schilder coll. No. 3729; now ZM, Berlin (Kilias, *in litt.*)

Discussion: Most shells of this species, examined in this study, are somewhat broader at the shoulder of the body

whorl than Schilder's type specimen, which appears to be smaller than average.

6. *Proterato (Sulcerato) pura* (Kuroda & Habe, 1971)

(Figure *8*: topotype, *ex* Habe)

1971 *Lachryma pura* Kuroda & Habe, The shells of Sagami Bay: 96 [Engl. version]; 145 [Japan. version]; plt. 108, fig 23 (holotype)

Original Description: "Shell largest for this genus from Japan, translucent white, thin, rather solid, ovoid in shape narrowing downward and broadest at the shoulder of the body whorl. Spie [sic, spire] rather low and whorls covered with thin callus. Apex large and blunt, surface smooth and polished. Aperture narrow and long, with outer margin roundly winged at the shoulder and narrowly flattened at the edge on which about 22 teeth [are] present. Columellar margin slightly rostrated downward with three folds and about 12 weak teeth." (Kuroda & Habe, 1971: 96).

Measurements:

holotype: L – 8.5; W – 6.5; H – 3.4 mm
topotype (C4069): L – 4.8; W – 2.9; H – 2.5 mm
hypotype (C4070) (Figure *8*a): L – 8.5; W – 5.5; H – 4.5 mm

Type Locality: Sagami Bay, Japan

Distribution: (C4069): 75 - 85 m of water, Sagami Bay; (C4070): Moeshima, 86 m, Kagoshima Bay, Kyushu, Japan; Kannontsukadashi-Maruyamadashi, 84 m; [5.5 km W of] Jogashima, in 100 - 110 m of water, also in 73 - 85 m nearby; 2 km SSW of Jogashima in 65 - 72 m [alive], and 2 km WNW in 50 m. Dispersal is generally in east coastal waters from Sagami Bay (Honshu) in the north, south to Shikoku and Kyushu. Usually on sandy bottom, from 50 to 300 m in depth.

Holotype: His Majesty's, the Emperor of Japan, coll., National Science Museum, Tokyo (Habe, *in litt.*)

Discussion: The species is compared with *Lachryma callosa* (A. Adams & Reeve, 1850) and *L. tomlini* (Schilder, 1933): "... in having the large, pure white shell with the more elevated spire and the wider aperture." Habe also reports specimens from the Pleistocene of Moeshima, Kagoshima Bay; Kyushu, and Jogashima, Japan.

7. *Proterato (Sulcerato) sandwichensis* (Sowerby 2nd, 1859)

(Figure *10*: lectotype)

1859 *Erato sandwichensis* Sowerby 2nd, Thesaur. Conchyl. *Erato* 3: 82; figs. 21-22
1860 *Erato sandwicensis* [err.]. Pease, Proc. Malacol. Soc. London 28: 146

Original Description: "*Erato sandwichensis* – – *E. testá tenui, oblongo subpyriformi, pallidè roséa, fusco trifasciatá laevi; labio externo angusto, vix crenulato, posticè paululum elevato.*" (Sowerby 2nd, 1859: 82)

Description, hypotype: Shell small, solid, ovate, somewhat inflated subcentrally, narrowing evenly toward the front; dorsum smooth; apex of 3 whorls, each broadening toward the body whorl; base smooth, inflatedly ovate; aperture straight, oblique from axis, evenly broad throughout; outer lip forming sharp angle to body whorl (columella) adapically; otherwise, outer lip broad, ventral surface curving from outside to within, thickly formed but not shouldered above; numerous very fine denticles on inner edge; columella fairly broad, flattened, deepening to the front as a fossula, with fine angular plaits (7) at the front; color off-white over all except that 2 wide transverse bands of greyish-green divide dorsal surface; tip of protoconch solid brown. (C4019).

Measurements:

lectotype (designated herein): L – 5.2 mm (Way, *in litt.*)
hypotype: L – 4.8; W – 2.8; H – 2.3 mm (C 4019) (Figure *10*a)

Explanation of Figures *8* to *11*

Figure *8*: *Proterato (Sulcerato) pura*, Draper photo, paratype [6] × 13
Figure *8*a: *Proterato (Sulcerato) pura*, Draper photo, hypotype fossil, [6] × 7
Figure *9*: *Proterato (Sulcerato) lepida* [= *Marginella (Glabella) lepida* Gould, 1860], USNM photo, holotype [5] × 9
Figure *10*: *Proterato (Sulcerato) sandwichensis*, BMNH photo, [7], lectotype × 12
Figure *10*a: *Proterato (Sulcerato) sandwichensis*, Draper photo, [7], hypotype × 13
Figure *11*: *Proterato (Sulcerato) stalagmia*, Draper photo, [9], holotype × 9

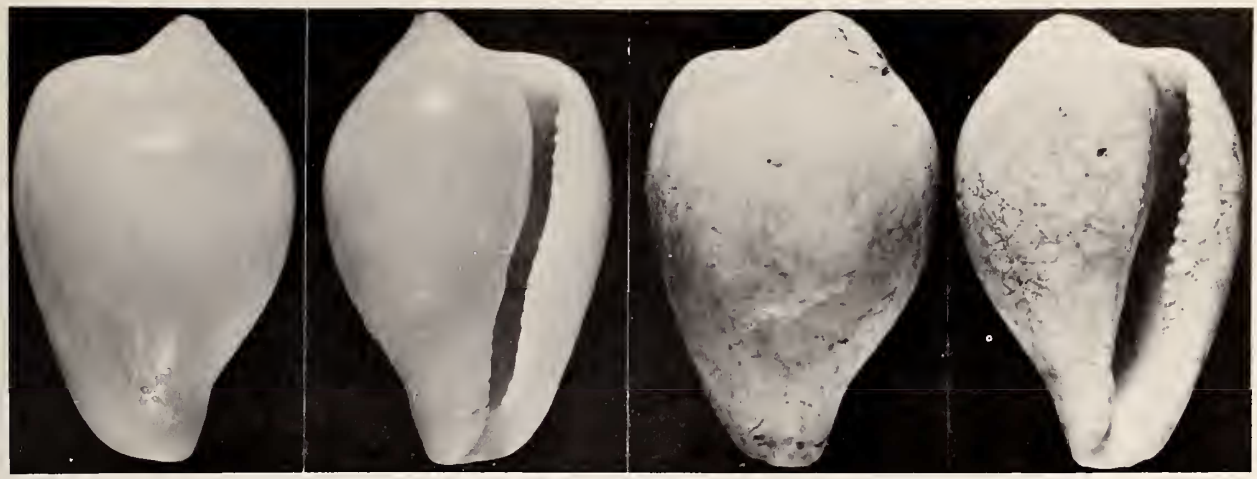

Figure *8*

Figure *8*a

Figure *9*

Figure *10*

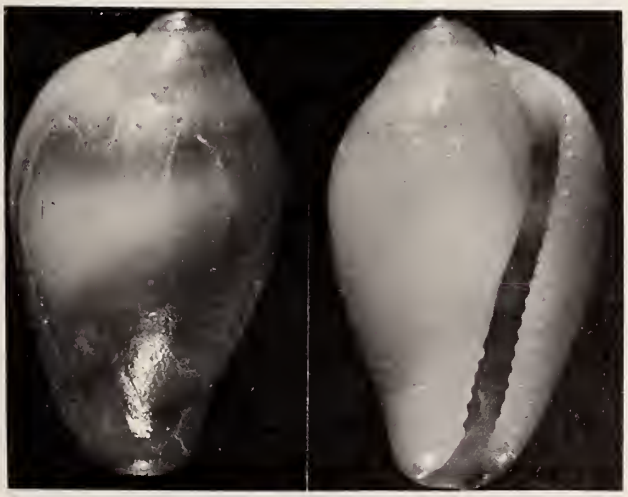

Figure *10*a

Figure *11*

Type Locality: Sandwich Islands [Hawaii].

Distribution: Laysan Island, French Frigate Shoals; Tuamotu Archipelago; Makatea, Rangiroa Islands (224 km NNE of Tahiti); Hawaii: Oahu: Kaneohe Bay, Waimea Bay, Haleiwa Bay, Waikiki, Oahu generally; Maalaea Bay, Maui; Kailua, Kawaihae, NW Hawaii Island; Port Allen, Kauai, Hawaiian Islands.

Lectotype: BM(NH), Register No. 1962776 (Kay designation 1964, Way, *in litt.*)

Discussion: Of this species, Sowerby 2nd, (1859) remarked: "Narrower and thinner than *E. guttata*, with distinct bands, and the outer lip narrower and not so elevated." Sowerby 2nd appears to be comparing this species with one of his earlier species, *Erato guttata*, which he had described in 1832 as *E. guttula*. The prior name appears to have been misspelled. Reeve (1865), in reference to *E. guttata* Sowerby 2nd, 1859, observed: "This specimen is named in Mr. Cuming's collection *E. guttata*, but it is in such bad state that I must refrain from describing it as a species." However, E. A. Smith (1910), established that Sowerby's species, *E. guttula*, is a marginellid; Reeve's illustration tends to bear out the Smith opinion. Thus, it would seem that both names were invalidly established and unavailable.

8. *Proterato (Sulcerato) callosa* (A. Adams & Reeve, 1850)

(Figure *12*: lectotype)

1850 *Erato callosa* A. Adams & Reeve, Zool. Voy. Samarang, Moll., London: 25; plt. 10, fig. 32

Original Description: "*Erato callosa* -- *Erat. testá pyriformi, crassá, tumidá, callosá, spirá breviusculá, subobtusá, columellá excavatá, labro conspicuè denticulato; carneá, subtus albicante.*" (A. Adams & Reeve, 1850: 25)

"Shell pyriform, thick, swollen, solid, spire short, blunt, columella excavated, lip conspicuously denticulate; flesh colored, somewhat white" [C. N. Cate, transl.].

Description, hypotype: Shell small, pyriformly ovate, body whorl large, roundly elevated, inflated; spire evenly tapered, moderately elevated, consisting of 2 very broad whorls, and one very narrow, hardly discernible; dorsum smooth, having characteristic off-white transverse bands in the rear dorsal sutures, and across the body whorl centrally; base smooth, ovate, apertural side somewhat straightened; columella broad, concave, without fossular depression; aperture fairly wide, almost straight, though obliquely angled from shell axis; outer lip thick, broad, sloping, curving abaperturally to outer lip margin; both columella and inner edge of outer lip finely dentate, columellar teeth almost obscure; shell color pale brown, except that dorsal band, sutures, front terminal projection, base, columella, lip and teeth are off-white (C4021; Figure *12*a).

Measurements, lectotype (here designated): L – 7.2 mm (Way, *in litt.*)

Measurements, hypotype (C4021): L – 7.0; W – 5.8; H – 4.8 mm

Type Locality: "China Seas." Designated herein: Drushi, Japan.

Distribution: Usually occurring in coarse sand and among rocks; Genkai Nada; Kushimoto; Ariake Sea; Shirahama; Tomika; Aizu; Shinomisaki; Kada; Mera; and the Kii Channel, Japan (Habe, *in litt.*).

Lectotype BM(NH), Register No. 197411/1 (one of 3 syntypes, designated herein, Way, *in litt.*)

Discussion: Adams & Reeve made the following comment: "An interesting species of rather large size, distinguished by its callous, thickly enamelled growth."

9. *Proterato (Sulcerato) stalagmia* Cate, 1975

(Figure *11*, holotype)

1975 *Proterato stalagmia* Cate, The Veliger **17** (3): 261; fig. 6

Original Description: "Shell small, narrowly pyriform, without acute lip and body angles; terminals fairly prominent, bluntly pointed adapically, broadly formed in front; dorsum smooth, polished, without sculpture; base narrowly ovate, broader sub-centrally, narrowing solidly to the front, surface smooth, polished; columella fairly broad, concave, deepening in the fossula area; aperture uniformly narrow, almost straight, though slightly angled to the left posteriorly. Base teeth: ventral edge of columella very finely crenate (clearly visible under magnification), with approximately 8 strongly formed, lengthened denticles extending over entire base and terminal ridge; outer lip broad, convex, not shouldered above, and having numerous (23) small, short teeth along apertural edge; basic shell color very pale greyish-white, with expanded pale dark green clouding dorsally, first two whorls of apex brown." (Cate, 1975: 261)

Measurements, holotype: L – 6.5; W – 3.7; H – 3.2 mm

Type Locality: Shallow water, Maqueda Bay, Samar, Philippines.

Holotype: LACM No. 1703

Discussion: This species differs from *Proterato callosa* (A. Adams & Reeve, 1850) by having a narrower shell, a nearly straight aperture, much finer, less distinct outer lip teeth; by having long, boldly formed denticles traversing the front base; by its brown colored apex; and by having a less distinct, greater dispersal of coloring on the dorsum.

10. *Proterato (Sulcerato) recondita* (Melvill & Standen, 1903)

(Figure *14*, lectotype)

1903 *Erato recondita* Melvill & Standen, Ann. Mag. Nat. Hist. 12 (7): 302; plt. 21, fig. 9

1903 *Erato recondita* var. *haplochila* Melvill & Standen, Ann. Mag. Nat. Hist. 12 (7): 302; plt. 21, fig. 10.

Lectotype: BM(NH), Reg. No. 1903:12:15:49 (Way, *in litt.*) (Figure *15* herein)

Original Description: "*Erato recondita* – – *E. testa parva, nitida, alba, laevissima, tenui, anfractibus* 5½, *apicali obtuso, mamillato, caeteris laevibus, immaculatis, ultimo magnopere exsuperante; apertura angusta, labro supra paullum effuso, nitido, albo, incrassato, intus minute denticulato.*" (Melvill & Standen, 1903: 302).

Measurements: "Long. 5, lat. 3 mm. (sp. maj.)" (Melvill & Standen, 1903: 302)

Measurements, lectotype: L – 5.2 mm (Way, *in litt.*).

Type Locality: "Hab. Gulf of Oman, lat. 24°58′ N., long. 56°54′ E., 156 fathoms" [285 m]

Distribution: Arabian Sea: Kuria, Muria, Oman, Muscat

Lectotype, designated herein: BM(NH), Register No. 1903:12:15:47; two syntypes in type lot (Way, *in litt.*)

Discussion: Melvill & Standen listed the varietal name: "Var (vel. so.?) *haplochila*, nov."

11. *Proterato (Sulcerato) geralia* Cate, spec. nov.

(Figure *13*, holotype)

Description: Shell small, roundly pear-shaped, solidly formed; terminals well developed, prominently in front, with a blunt, shortened apex adapically which is almost enveloped by rear angle of the outer lip; body whorl inflated, dorsum smooth, glossy; base smooth, glossy, roundly convex sub-centrally, narrowing toward the front; aperture almost straight, narrow; columella well defined, concave, deepening in the abapical fossular area; outer lip broad, surface rounded, smooth except for numerous very small fine teeth on the apertural edge, denticles lengthening in front to the terminal ridge; shell color creamy-white over all, except that apex and front terminal canal opening are deep rose-lavender. (C3621)

Measurements:
Holotype: L – 3.8; W – 2.7; H – 2.1 mm (C3621)
Paratype 1: L – 3.9; W – 2.8; H – 2.2 mm (C3621b)

Type Locality: Geralia, Exmouth Gulf, NW Australia, 22°00′ S; 114°15′ E.

Distribution: Lighthouse Beach, Vlaming Head, NW Cape: in sand generally throughout the Cape and Exmouth Gulf Area, NW Australia. Specimens collected in the tide drift by Mollie Gedling, Cape Light Keeper, and Leslie Figgis, Geralia.

Holotype: LACM No. 1763

Discussion: The shells of this species were fairly common in the high tide drift. Because of the low, broad, blunt spire and the lengthened outer lip to the rear, this new eratoid is morphologically unusual and may be easily separated from its congeners. It may be compared with *Proterato stalagmia* Cate, 1975 (Figure *11*), from which it differs by having a broader, rounder, more globose body whorl; by having a different basic shell color, with

Explanation of Figures *12* to *15*

Figure *12*: *Proterato (Sulcerato) callosa*, BMNH photo, [8], lectotype × 9

Figure *12a*: *Proterato (Sulcerato) callosa*, Draper photo [8], hypotype × 10

Figure *13*: *Proterato (Sulcerato) geralia*, Draper photo, [11], holotype × 18

Figure *13a*: *Proterato (Sulcerato) geralia*, Draper photo [11], paratype × 16

Figure *14*: *Proterato (Sulcerato) recondita*, BMNH photo, [10], lectotype × 13

Figure *15*: *Erato recondita* var. *haplochila*, BMNH photo [10], lectotype × 13

Figure *12*

Figure *12*a

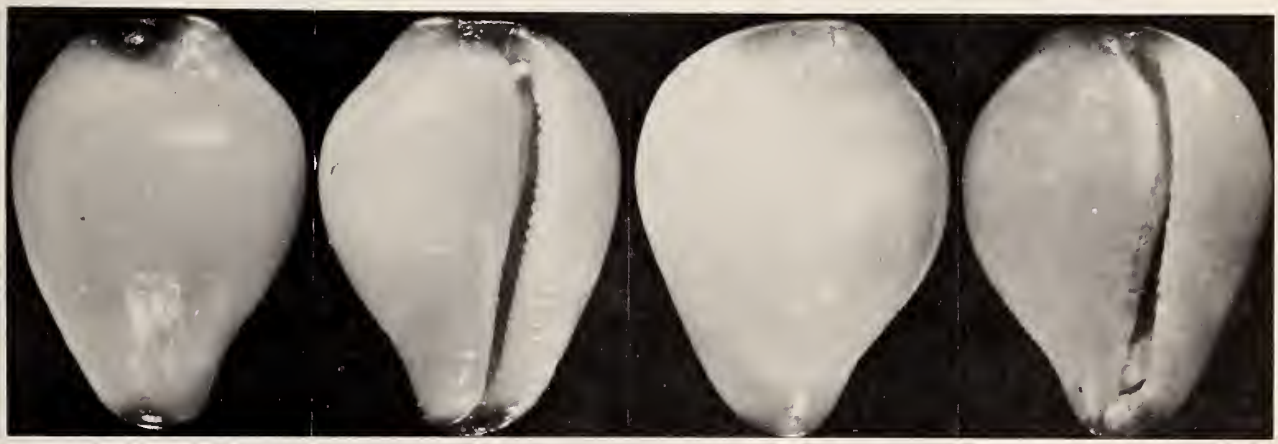

Figure *13*

Figure *13*a

Figure *14*

Figure *15*

rose-lavender apex; by having a shorter, more heavily formed apex; and by having a slightly larger combination of denticles bordering a more curving aperture. The name is derived from Geralia, Exmouth Gulf, NW Australia, where these shells appear to be fairly common, especially in the high tide drift.

Proterato (Sulcerato) geralia may also be compared with *P. (Cypraeerato) bimaculata* (Tate, 1878) (Figure 22) from South Australia, from which it differs by being a smaller, shorter, more spherical shell; by having a more curving, somewhat broader aperture; by having more numerous, finer teeth on the inner edge of the outer lip; by having a different set of shell colors, creamy-white overall except that the extremities are covered with an intense rosy-lavender color.

12. *(Eratoena)* Iredale, 1935

Type species: *Ovulum corrugatum* Hinds, 1845 [OD], Zool. Voy. Sulphur, Moll.: 47; plt. 16, figs. 5-6

Diagnosis: "The small sculptured species are very distinct from the larger smooth forms of *Lachryma* [Iredale, 1931], and as they seem to be represented in the fossil state as *Eratopsis* [Hoernes & Auinger, 1880, a genus consisting of 14 fossil and one Recent species, *E. prayensis* Rochebrune, 1881] from the Miocene of Austria, the tropical recent species are here separated. The nodulation makes the species easily recognisable, but when this is subobsolete the apertural characters distinguish them." (Iredale, 1935: 97)

13. *Proterato (Eratoena) corrugata* (Hinds, 1844)

(Figure *16*, lectotype)

1844 *Ovulum corrugatum* Hinds. Zool. Voy. Sulphur, Moll. **2**: 47; plt. 16, figs. 5-6

Original Description: "*Ovulum corrugatum* – – *Testá parvá, pallidè virente, dorsò corrugatá, lineá medianá conspicuá; aperturá angustá, ad basin fusco pictá.*" (Hinds, 1844: 47)

Shell small, pale green, dorsum corrugated, conspicuous median line; aperture narrow, base ornately darkened.

Description, lectotype: "Shell ovately pyriform, yellowish-white, spire obtuse, whorls rather swollen, obscurely minutely wrinkled [pustulate] at the upper part, columella and lip much swollen, aperture very narrow." (Reeve, 1865)

Measurements, lectotype: L – 3.9mm (Way, *in litt.*)

Type Locality: "New Guinea; in five to twenty-one fathoms [9 to 38m], among soft mud."

Distribution: Island of Mindoro, Philippines, in sandy mud, at a depth of 14½m; Loyalty Islands; New Caledonia; Eitape (New Guinea); Astrolabe Bay, Bismarck Sea, NE of central coast of New Guinea; New Guinea; Queensland coast of Australia; Port Curtis, Brisbane (Moreton Bay), Mackay River.

Lectotype (designated herein): BM(NH), Register No. 1844:6:7:49 (two syntypes in type lot (Way, *in litt.*).

Paralectotype: Figure *16*a

Discussion: Hinds' holotype appears to be missing or undesignated. The Reeve (1865) figure seems to illustrate the lectotype shown herein (Figure *16*).

Along with the 2 mentioned syntypes (Figure *16*a) which comprise the type lot, is a third shell (Figure *23*a), which seems more typical of the species *Proterato (Cypraeerato) gemma gemma* (Bavay, 1917). It shows an abundance of dorsal pustulations, whereas the 2 Hinds' syntypes of *P. (Eratoena) corrugata* are very badly worn and decorticated.

14. *Proterato (Eratoena) nana* (Sowerby 2nd, 1859)

(Figure *17*, lectotype)

1859 *Erato nana* Sowerby 2nd, Thes. Conchyl., *Erato*: 82; figs. 12-13

Original Description: "*E. testá albá, ovali, oblongá, minutissimè granulatá; sulco dorsali angustato, labiis minutè crenulatis.*" (Sowerby 2nd, 1859: 82)

Shell white, ovate, oblong, minutely granular; dorsal sulcus narrow, lip minutely crenulate.

Measurements:
lectotype: L – 3.6mm
hypotype: L – 4.0; W – 2.5; H – 2.0mm (C4067; Figure *17*a)

Type Locality: "Hab. —." Designated herein as Amami-Oshima, south of Kyushu, Japan (28°15′N; 129°15′E)

Distribution: Shinomisaki, Wakayama, Honshu, Japan (Habe, *in litt.*)

Lectotype (designated herein): BM(NH), Register No. 197313/1 (there are 4 syntypes in the type lot; Way *in litt.*)

Discussion: Sowerby 2nd remarked: "More elongate and more minutely granulated than *corrugata*." Having studied a number of the shells from Japan, I agree with Sowerby's comparison with the shells of *Proterato (Eratoena) corrugata* (Hinds, 1844). He might also have included the absence of the longitudinal dorsal furrow, often missing in some specimens, that is generally so prominently visible in this species. It would seem the shell morphology and pustulation of this species are intermediate between *P. (E.) corrugata* and *Hespererato scabriuscula* (Gray, 1827), the latter being also pustulate but narrower, longer, and with a more elongate spire. Though normally pustulate, the *P. (E.) corrugata* syntypes are decorticated and lack the dorsal medial furrow. In addition, *P. (E.) corrugata* and *P. (E.) nana* are separated by their exceedingly distant living ranges.

15. *Protoerato (Eratoena) sulcifera sulcifera* (Sowerby 2nd, 1832)

(Figure *18*, Reeve figured specimen)

1832 *Erato sulcifera* Sowerby 2nd, Conch. Illustr., *Erato* (in Cypraeidae) 15; fig. 45

Original Description: "*Erato sulcifera* – – Shell ovate, turbinate, pallid, very minutely and distinctly granular, dorsal line wide, deeply impressed; aperture linear, very narrow, outer lip thickened, nearly white, minutely toothed on its inner margin; anterior part of the columellar lip minutely toothed; a single red spot at the anterior extremity." (Sowerby 2nd, 1832: 15)

Measurements:
"length 0.2, breadth 0.1" [inches] [= 5.0, 2.5 mm) (Sowerby 2nd, 1832: 15)
lectotype: L – 6.3 mm (Way, *in litt.*)

Type Locality: "Cape of Good Hope."

Distribution: SE coast of Africa; Natal; Berbera (Somali Republic); Assab, Dahlak, Eritrea; Palk Bay, Ceylon.

Reeve figured specimen: BM(NH) (Way, *in litt.*) Sowerby appears not to have selected a holotype.

Discussion: Sowerby 2nd mentions a single specimen in "the late G. Humphrey's collection." It appears to be unknown how this specimen relates to the shells to which Reeve had access. This species has a long and diversified living range, with the shells seeming to be small or large, depending upon the locality; appearing larger as the range extends northward into Japanese waters. Although different authors have identified these shells under different names, the species appears to be distinct; it has a peculiar narrowness in its shell shape when compared with other pustulate eratoid species.

16. *Proterato (Eratoena) sulcifera capensis* Schilder, 1933

(Figure 19, Schilder text figure)

1933 *Proterato capensis* Schilder, Proc. Malacol. Soc. London **20**: 261; fig. 22

Explanation of Figures *16* to *18*

Figure *16*: *Proterato (Eratoena) corrugata*, BMNH photo, [13], lectotype × 16
Figure *16a*: *Proterato (Eratoena) corrugata*, BMNH photo, [13], paratype × 16
Figure *17*: *Proterato (Eratoena) nana*, BMNH photo, [14] lectotype × 17
Figure *17a*: *Proterato (Eratoena) nana*, Draper photo, [14], hypotype × 16
Figure *18*: *Proterato (Eratoena) sulcifera sulcifera*, BMNH photo, [15] Reeve figured specimen × 9

Explanation of Figures *20* to *23*

Figure *20*: *Proterato (Eratoena) schmeltziana*, MNHN photo, [17], holotype × 20
Figure *21*: *Proterato (Eratoena) smithi*, ZM photo, [18], holotype × 12
Figure *22*: *Proterato (Cypraeerato) bimaculata*, SAM photo, [20] holotype × 17
Figure *23*: *Proterato (Cypraeerato) gemma gemma*, BMNH photo, [21] holotype × 23

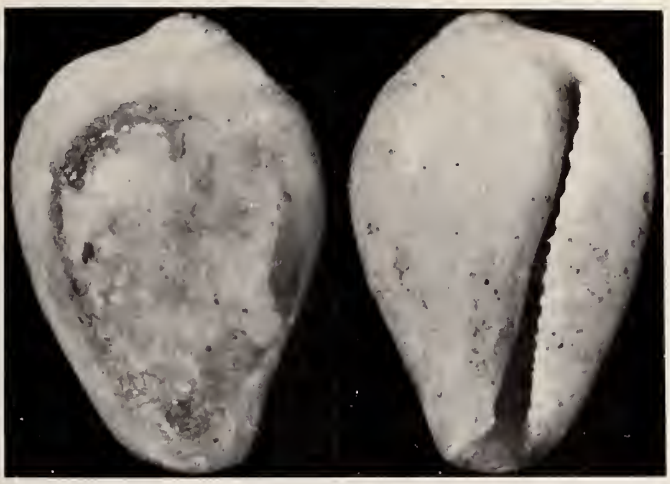

Figure *16*

Figure *16*a

Figure *17*

Figure *17*a

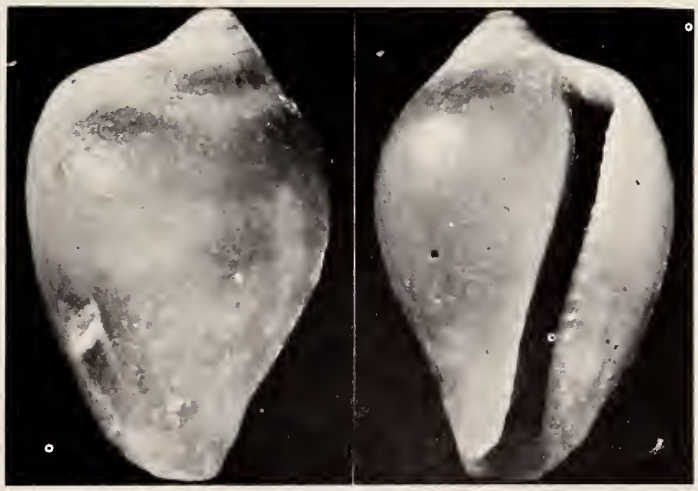

Figure *18*

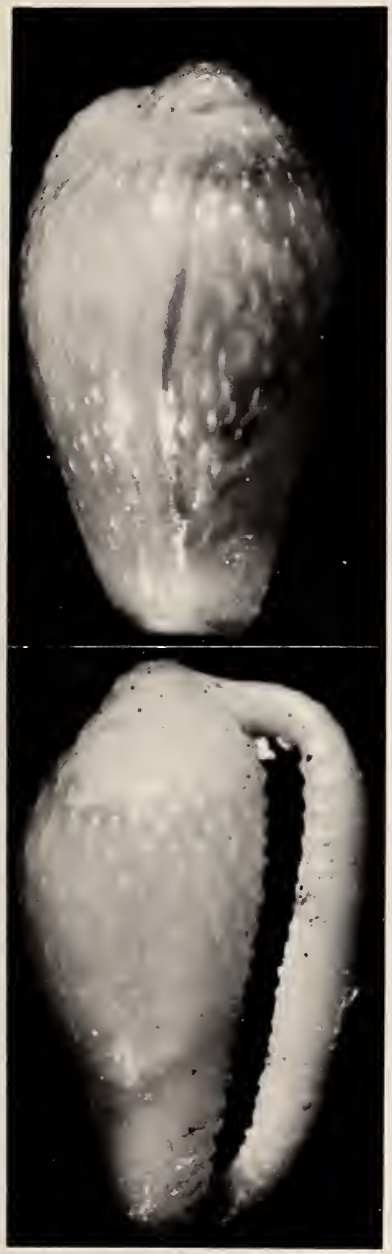

Figure 20

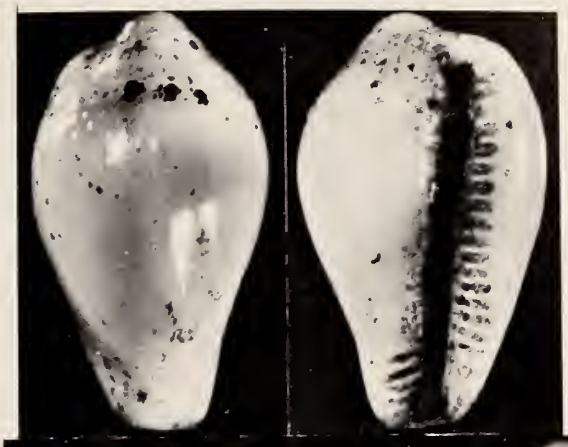

Figure 21

Figure 22

Figure 23

Original Description: "*Proterato capensis* – – Intermediate between *sulcifera* and *smithi*: granulation restricted as in *smithi*, but dorsal sulcus well developed at least on the extremities; greenish, extremities unspotted." (Schilder, 1933: 261)

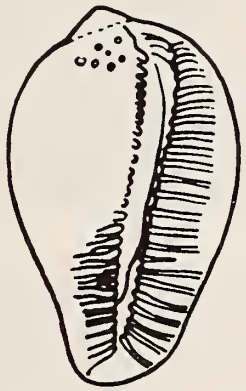

Figure 19

Proterato (Eratoena) sulcifera capensis
Drawing by F. A. Schilder, Type [16] × 20

Measurements, holotype: "L – 3.9mm; and 19 labial and 15 columellar teeth."

Type Locality: "Port Shepstone [S Natal, E Union of South Africa]"

Distribution: From Algoa and Jeffrey's Bay, Durban, south to the Port Alfred area.

Holotype: Not in Tomlin collection, NMW (Chatfield, *in litt.*); not in MZ (Kilias, *in litt.*). Type specimen lost or misplaced.

Discussion: Many of Schilder's type descriptions are comparative in nature, referring to charts, graphs, and tables. For a serious consideration of these species, the student will need to consult the original references to this and some other of his species, for descriptive detail.

17. *Proterato (Eratoena) schmeltziana* (Crosse, 1867)

(Figure *20*, holotype)

1867 *Erato schmeltziana* Crosse, Journ. Conchyl. 15: 301; plt. 11, fig. 5

Original Description: "*Erato schmeltziana* – – *T. oblonga, minutissime et obsolete granulata, nitida, pallide albido-viridula, spira parvula, obtusa; anfr. pauci, parum conspicui, ultimus ascendens, fere totam testae longitudinem formans, sulco dorsali, angusto, laevi, longitudinaliter divisus, basi attenuatus et ex utroque latere violaceo bimaculatis; apert. elongata, subconstricta; marginibus albidis, denticulatis; basi plicatula.*" (Crosse, 1867: 301)

"Shell oblong, shining, covered with very fine obsolete granulations, and of light water-green coloration. The spire is small and obtuse. The spire whorls are few in number and barely apparent; the last, rising and constituting nearly the entire shell, is divided longitudinally by a well defined dorsal furrow, straight and smooth; it is attenuate at the base, which carries at each corner, at the extreme end, two small carmine-violet spots. The aperture is long and fairly straight; its edges are whitish and denticulate." (translated from the accompanying French description by Jean M. Cate)

Measurements, holotype: "Long. $3\frac{1}{2}$, diam. maj. $1\frac{3}{4}$ mill., (Mus. Godeffroy)." [Hamburg].

Type Locality: "Hab. Archip. Viti (Dr. Graeffe)." [Fiji Islands]

Holotype: MNHN, currently without number (Testud, *in litt.*)

Discussion: Crosse stated: "We hardly know a species among its congeners with which to compare it except *Erato nana* Duclos [sic, should be Sowerby 2nd, 1832], but it is more elongate than that species, more finely granulose and greenish, instead of being white; it is further distinguished by the reddish spots at the base.
"Further, if we compare it with the measurements of the Duclos [sic] species in the Thesaurus, the Duclos [sic] species would be a little larger and a bit wider ($4\frac{1}{2}$mm × 3, instead of $3\frac{1}{2} \times 1\frac{3}{4}$). *E. corrugata* Hinds, which also has similar, stronger granulations, is easily distinguished by its shape, more globose than that of *nana*." Crosse appears to have overlooked *Erato sulcifer*a Sowerby 2nd, 1832, a species with which *E. schmeltziana* should be compared, and which may possibly be the same species. However, their widely separated type localities suggest, for the time being, conditional separation. Schilder (1933) unqualifiedly states that they are the same species.

18. *Proterato (Eratoena) smithi* Schilder, 1933

(Figure *21*, holotype)

1933 *Proterato (Proterato) sulcifera smithi* Schilder, Proc. Malacol. Soc. London 20: 248, 271; fig. 24

Original Description: "*Proterato (Proterato) s.* [*sulcifera*] *smithi* – – Allied to *sulcifera*, differs by the granulation restricted to the posterior extremity and the spire, and by the total absence of the dorsal sulcus; white, rather callous, anterior extremity unspotted." (SCHILDER, 1933: 248) (It should be noted that SCHILDER (1971: 13) recognized *P. (P.) smithi* as a distinct species, as listed herein).

Measurements, holotype: Approximately 4.7 mm (Kilias, *in litt.*).

Type Locality: Mauritius

Distribution: W Indian Ocean; Mascarene Islands (comprising Réunion, Mauritius, and Rodriguez island groups, 640 and 800 km E of Madagascar).

Holotype: MZ, without number: *ex* Schilder coll. No. 3587 (Kilias, *in litt.*)

Discussion: Schilder commented: "This race of *sulcifera* is evidently common at Mauritius, as it has been described as nameless variety of *sulcifera* by [E. A.] Smith (1910) [p. 20] from this island and J. R. le B. Tomlin, Ph. Dautzenberg and the museum of Berlin possess similar shells from Mauritius, too."

It should be noted that this author has seen several of the dorsal surface variations mentioned by both Schilder and Smith. In almost every instance of a long series of shells belonging to the granular (pustulose) eratoid species, one may observe shells only partly granulose (see Figure *21*), some even without pustules in newly adult specimens, having various amounts of granular deposit, or shells which have not yet developed the longitudinal furrow. It is therefore important to be wary of using granulations and furrow as deciding factors in the determination of some species.

19. *(Cypraeerato)* Schilder, 1932

Type species: *Erato bimaculata* Tate, 1878 [OD]. Trans. Phil. Soc. Adelaide 1: 88

Diagnosis: The shells in this subgeneric group are more pyriform, with a greater acute constriction of the base and outer lip anteriorly; the fossula is deeply concave, and has a distinct angular expansion.

20. *Proterato (Cypraeerato) bimaculata* (Tate, 1878)

(Figure *22*, holotype)

1878 *Erato bimaculata* Tate, Trans. Phil. Soc. Adelaide 1: 88

Original Description: "*Erato bimaculata* – – Shell minute, ovately pyriform, pale primrose-yellow to yellowish-white, with rufus red around the extremity of the anterior canal and on the callus border to the hinder part of the aperture; body whorl swollen, constricted at the base; outer lip stoutly swollen, extending to the apex of the spire, with about twenty-five strong, transverse plicae; aperture very narrow, curved, emarginate posteriorly; columella with eight crowded transverse plicae." (TATE, 1878: 88)

Measurements, holotype: "Length .17, breadth, .12 inch." [L – 4.2; W – 3.0 mm]

Type Locality: "Washed up. - St. Vincent's Gulf [S Australia] at Aldinga and Marino."

Distribution: Semaphore, NE Tasmania; Surveyor's Point [near Hobart], NE Tasmania; S Australia: Spencer's Gulf, Port Lincoln; Eucla; Great Australian Bight.

Holotype: AM, No. C 57760; 6 paratypes in type lot (Ponder, *in litt.*).

Discussion: Tate's comment about the species: "*E. bimaculata* closely resembles *E. angulifera* (Reeve) [sic] [Sowerby, 1859] from Borneo, but it has a less angular and inflated body whorl, and the coloration is peculiar. Three other species are known to inhabit the Australian seas, but they have little affinity with our shell."

A new species, described herein, *Proterato geralia*, is compared with this species (see above).

Explanation of Figures *23*a to *28*

Figure *23*a: *Proterato (Cypraeerato) gemma gemma*, BMNH photo [21] (see also account under [13]) × 25

Figure *25*: *Alaerato gallinacea*, BMNH photo, [24], lectotype × 14

Figure *25*a: *Alaerato gallinacea*, BMNH photo, [24], paralectotype × 14

Figure *26*: *Alaerato amamioshima*, Draper photo, [26], holotype × 11

Figure *27*: *Alaerato bisinventa*, AM photo, [25], holotype × 12

Figure *28*: *Alaerato angulifera*, BMNH photo, [27], lectotype × 17

Figure 23a

Figure 25

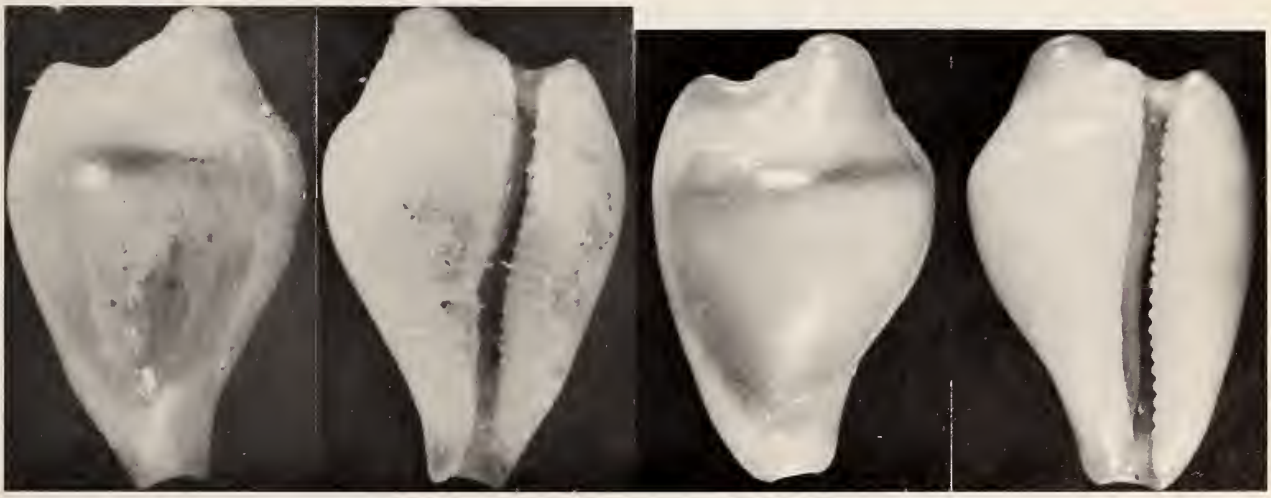

Figure 25a

Figure 26

Figure 27

Figure 28